REMARKS

This reply encompasses a bona fide attempt to address the rejections raised by the Examiner and presents amendments as well as reasons why the applicants believe that the claimed invention is novel and unobvious over the closest prior art of record, thereby placing the present application in a condition for allowance.

Regarding Claim Status

Claims 1, 2, 4-7 and 37-44 were examined. Claims 1, 2, 4-7 and 37-44 were rejected. Claims 1, 4-6 and 39-44 are amended herein. Claims 2 and 7-38 are cancelled herein. By this Amendment, claims 1, 4-6 and 39-44 are pending.

Regarding 35 U.S.C. § 112 Rejections

Claims 1, 2, 4-7 and 37-44 were rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s) at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner has rejected a generic claim to a proteorhodopsin gene as an isolated DNA molecule comprising a nucleotide sequence encoding a proteorhodopsin protein with at least 78% sequence identity to SEQ ID No:7. Applicants have amended claim 1 to recite two specific variants of a proteorhodopsin protein, as shown in SEQ ID NOs: 5 and 7. Support for this amendment can be found on page 19, line 6, to page 21, line 11, as well as FIG. 4 and FIG. 5.

The Examiner also rejected the above claims under 35 U.S.C. § 112, first paragraph, for failure of Applicants to furnish a statement that all restrictions on the accessibility of the

deposit will be irrevocably removed by the applicant upon the granting of the patent. A statement by the Assignee of this invention, Monterey Bay Aquarium Research Institute, is enclosed herewith.

It is therefore respectfully submitted that amended claim 1 is fully supported by the specification as filed and should therefore be allowed. As amended claims 4-6 and 39-44 are dependent, either directly or indirectly, on amended claim 1, Applicants respectfully submit that these claims should also be allowed.

Regarding Claim Interpretation

A) The examiner submits that the term "proteorhodopsin" is not defined in the specification. Applicants respectfully submit that this is not the case. As found in the specification as filed, proteorhodopsin has the following structural and functional properties:

1) It contains seven transmembrane domains (page 20, lines 11-13 and FIG. 5);

2) It contains a retinal binding pocket (page 20, lines 13-14 and FIG. 5);

3) It is found in members of the domain Bacteria (page 4, lines 19-20);

4) It can integrate with the cell membrane of a host (such as bacteria or yeast) and bind retinal upon expression of a construct containing a proteorhodopsin gene in the host (page 25, lines 21 and page 29, line 17 to page 31, line 9);

5) It functions as a light driven proton pump (page 26, lines 10-11, and page 32, line 8 through page 34 , line 8);

6) It has an amino acid sequence with at least 78% identity to SEQ ID No:7 (page 25, line 1-12).

This set of structural and functional features is not shared by any other members of the rhodopsin family. For example, visual rhodopsins, found in eyes throughout the animal kingdom, are photosensory pigments. The closest sensory rhodopsin to proteorhodopsin is the sensory rhodopsin from Natronomonas pharaonis, with a random expectation value of 2 X 10^{-10} and 30% identity in a 224-amino acid alignment (see page 6, lines 21-25 of U.S. Provisional application no. 60/201,602, which was incorporated by reference by the present application. A type of archael rhodopsin called bacteriorohodpsin functions as a light-driven proton pump, but cannot be functionally expressed in a bacterial or eukaryotic host. This is likely due to its normal environment having a salinity four to ten times greater than that of the sea. Indeed, it was found that in comparison to the most closely related archaeal sequences, the majority of non-conservative substitutions in proteorhodopsin resulted in changes in residue polarity, and were typically localized to regions of solution contact. In addition, in contrast to archaeal rhodopsins, proteorhodopsin lacks a region between helix B and C that adopts an extended conformation and is in contact with solution on the extracellular surface. (See page3, line 25 through page 4, line 8 and FIG. 2C of U.S. Provisional application no. 60/201,602). The closest bacteriorhodopsin to proteorhodopsin is from Halobacterium halobium, with a random expectation value of 9 X 10^{-9} and 27% identity over 228 amino acids (see page 6, lines 21-25 of U.S. Provisional application no. 60/201,602).

B) The Examiner has stated that "comprising a nucleotide sequence" is interpreted to mean any nucleic acid which has at least two nucleotides in common with the nucleotide sequence. Claim 1 has been amended to recite "the amino acid sequence" and claim 4 has been amended to recite "the nucleotide sequence".

C) Claim 39 has been amended, rendering this claim interpretation moot.

Regarding 35 U.S.C. § 102 Rejections

Claims 1, 2, 5 and 37 were rejected under 35 U.S.C. § 102(b) as being anticipated by Kitajima. The Examiner states that a nucleic acid encoding a CR1 protein has at least one dinucleotide identical to a sequence encoding an amino acid sequence of SEQ ID NO:7. The language in this claim has been amended to recite "the amino acid sequence". As none of the proteins described by Kitajima have the amino acid sequence of SEQ ID NO: 5 or 7, as claimed in amended claim 1, Applicants respectfully submit that amended claim 1 is novel over Kitajima and should be allowed. Claims 2 and 37 have been cancelled, rendering the rejection of these claims moot. As amended claim 5 is dependent on amended claim 1, it is respectfully submitted that claim 5 should also be allowed.

Regarding 35 U.S.C. § 103 Rejections

Claims 6, 39 and 41 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kitajima and Shimono. The Examiner states that it would have been obvious to clone the rhodopsin genes of Kitajima into an expression vector and put this into a bacterial host. This argument presupposes that proteorhodopsins are not patentably distinct from the rhodopsin genes of Kitajima. Applicants submit, for the reasons stated above, that the proteorhodopsin protein as defined in amended claim 1 is only distantly related to the rhodopsin proteins of Kitajima and is patentably distinct from the rhodopsin proteins of Kitajima. Thus, Applicants respectfully submit that amended claims 6, 39 and 41, which are dependent, either directly or indirectly, on amended claim 1, are not obvious from the combination of Kitajima and Shimono and should be allowed.

Claims 40 and 42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kitajima, Shimono, and Zozulya. Again, applicants submit that the proteorhodopsin protein as defined in amended claim 1 is only distantly related to the rhodopsin proteins of Kitajima and is patentably distinct from the rhodopsin proteins of Kitajima. Thus, Applicants respectfully submit that amended claims 40 and 42, which are dependent, either directly or indirectly, on amended claim 1, is not obvious from the combination of Kitajima, Shimono, and Zozulya.

Claim 43 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kitajima, Shimono, and Mollaaghababa. Again, applicants submit that the proteorhodopsin protein as defined in amended claim 1 is only distantly related to the rhodopsin proteins of Kitajima and is patentably distinct from the rhodopsin proteins of Kitajima. Thus, Applicants respectfully submit that amended claim 43, which is dependent indirectly on amended claim 1, is not obvious from the combination of Kitajima, Shimono, and Mollaaghababa.

Claim 44 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kitajima, Shimono, Mollaaghababa and Zozulya. Again, applicants submit that the proteorhodopsin protein as defined in amended claim 1 is only distantly related to the rhodopsin proteins of Kitajima and is patentably distinct from the rhodopsin proteins of Kitajima. Thus, Applicants respectfully submit that amended claim 43, which is dependent indirectly on amended claim 1, is not obvious from the combination of Kitajima, Shimono, Mollaaghababa, and Zozulya.

Conclusion

For the foregoing reasons, it is respectfully submitted that the invention as set forth in amended independent claim 1 recites subject matter that is fully supported by the specification, under 35 U.S.C. § 112, first paragraph, is novel, under 35 U.S.C. § 102(b) over Kitajima, and is patentably distinct, under 35 U.S.C. § 103(a), from Kitajima, Shimono, Mollaaghababa, and Zozulya. Accordingly, amended claim 1 is submitted to be patentable and therefore should be allowed. Amended claims 4-6 and 39-44 are submitted to be patentable as they are dependent on independent claim 1.

This Reply is submitted to be complete and proper in that it places the present application in a condition for allowance without adding new matter. Favorable consideration and a Notice of Allowance of all pending claims 1, 4-6 and 39-44 are therefore respectfully solicited.

Respectfully submitted,

Miriam Kaplan, Reg. No. 55,315
LUMEN INTELLECTUAL PROPERTY SERVICES
2345 Yale Street, Second Floor
Palo Alto, CA 94306
(O) 650-331-8417 (F) 650-424-0141